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# **Farmers Access to Climate Information for SDG Goals in Climate Change and Food Security.**

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# Outline

- Definitions (Climate Change & Food Security)
- Climate change linkages with agriculture and food security
- Climate change impacts
- Data and information access in SDG 2 and 13 mitigation
- Type of information product/ services to mitigate SDG 2 and 13
- Information access in sustainable & climate smart agriculture
- Agricultural Innovations
- Recommendations



# CLIMATE CHANGE

- NASA defines climate change as: "a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere.
- Increased temperature,
- Sea level rise; ice mass loss .....
- Shifts in flower/plant blooming
- Extreme weather events.



# FOOD SECURITY

2 ZERO HUNGER



- Food security exists when *all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life* (World Food Summit, 1996).

## Dimensions of food security:-

- *Physical availability* of food,
- The economic and physical *access to food*
- The *food utilization...* Nutrients influenced by people's health status
- The *stability of food security* at all times



# SDG Goals



- **Goal 2:** End hunger, achieve food security and improved nutrition and promote sustainable agriculture (5 + 3 sub targets)
  - *Food Security, End Malnutrition, Smallholder productivity, sustainable & Resilient production system, Agricultural Biodiversity.*
- **Goal 13:** Take urgent action to combat climate change and its impacts (3 targets)
  - *Resilience and adaptive capacity*
  - *Integrate climate change measures to national policies, strategies & planning*
  - *Educational awareness*

# CLIMATE CHANGE LINKAGES WITH AGRICULTURE AND FOOD SECURITY

Agriculture is not only a fundamental human activity at risk from climate change, it is a *major driver of environmental and climate change* itself.

- A significant contributor to land degradation and, in particular, a major emitter of greenhouse gases.
- Today, approximately **795 m** people across the globe do not have access to enough food for a healthy and sustainable life. Majority in underdeveloped countries (Laperrière, 2019).

# **Agriculture & Climate Change Circle**

**AGRICULTURE REDUCES  
FOREST ECOSYSTEMS,  
CLIMATE STABILIZATION,  
GLOBAL SERVICE**



**CLIMATE CHANGE INCREASES  
VULNERABILITY OF AGRICULTURE**

**AGRICULTURAL FRONTIER EXPANSION  
IS BASED ON DEFORESTATION**

**AGRICULTURE CONTRIBUTES  
TO CLIMATE CHANGE**

# **Anthropogenic Causes – enhanced GH Effect**

## **CO<sub>2</sub> to Atmosphere**

### **Human Activity**

- Combustion:  
Burning of coal and fossil fuels
- Deforestation

## **Methane to Atmosphere**

### **Human Activity**

- Landfills
- Agriculture (rice)
- Livestock

## **Other gases to atmosphere**

### **Human Activity**

- Ozone from car exhausts
- CFC's from aerosols



# GHGs Emissions - Agricultural Sector

Contributes 20% of global anthropogenic GHG emissions



50% of global methane emissions from enteric fermentation and rice paddies

70% of global N<sub>2</sub>O emissions from artificial fertilizers



5% of global CO<sub>2</sub> emissions from fossil fuel consumption and biomass burning



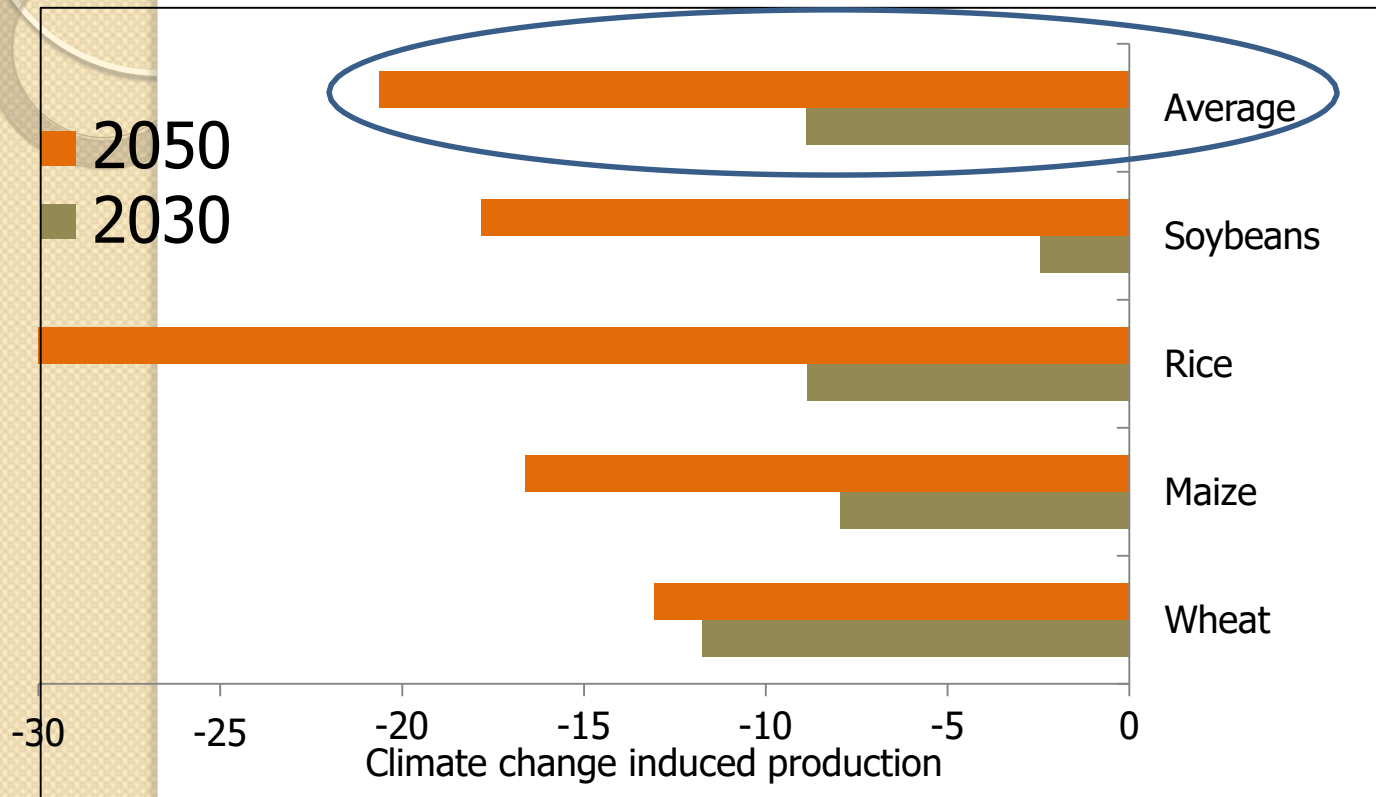
# CLIMATE CHANGE IMPACTS ...?

- Changes in temperatures and precipitation patterns will lead to changes in crop yields.
- Length of growing season will change.
- Natural disasters will decrease yields.
- Demand for water is increasing due to population growth and economic development.
- Biodiversity shifts – changes in crop varieties.
- New pests and diseases; it alters relationships among crops, pests, pathogens, and weeds.
- Food Security and Under-Nutrition.

# Impacts ....food security & under - nutrition...

- Climate change exacerbates under-nutrition through three causal pathways related to (or through combined effects on) *food security, care practices and health*
- Increase the incidence of diseases, such as malaria, thereby *increasing the caloric requirements* of affected populations

# Impact... Climate Change Reduces Global Food Availability



warmer temperature and changing rainfall patterns may reduce global food production by about **10% by 2030** and by more than **20% in 2050.**

*Source: Haile, von Braun, et al. 2016*

**New crop modeling results: +1°C ⇒ 4 to 6% yield loss in global wheat**

Source: Bing Liu et.al. 2016, Nature Climate Change

# Climate-Sensitive Elements of the Food System –

## COMPONENT

- **Photosynthesis**  
(temperature and soil moisture)

- **Weeds**

- **Pests**

- **Pathogens**

- **Floods, storms**

- **Droughts**

- **Conflict**

- **Poverty**

- **Transport**

- **Processing**

- **Distribution**

- **Storage**

**Food yield**

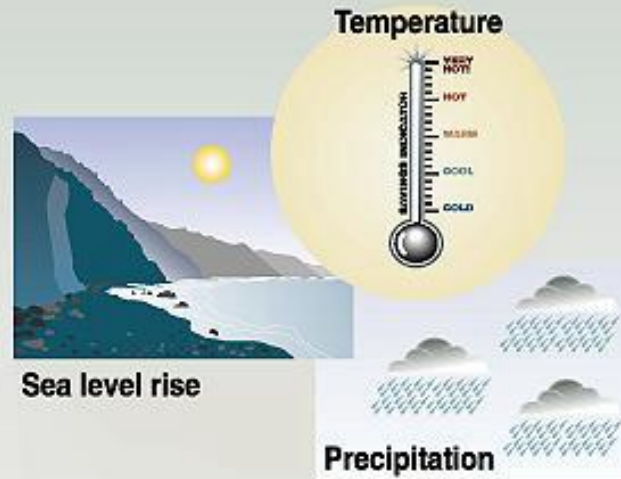
**Stability of food supply**

**Access to food**

**Food end-use**

Modeling to date focused on CC impacts based mainly on the photosynthetic yield – other paths affect F. yields

# Potential climate changes impact



## Impacts on...

### Health



Weather-related mortality  
Infectious diseases  
Air-quality respiratory illnesses

### Agriculture



Crop yields  
Irrigation demands

### Forest



Forest composition  
Geographic range of forest  
Forest health and productivity

### Water resources



Water supply  
Water quality  
Competition for water

### coastal areas



Erosion of beaches  
Inundation of coastal lands  
additional costs to protect coastal communities

### Species and natural areas



Loss of habitat and species  
Cryosphere: diminishing glaciers





Poor maize crop due to less rain, Uasin Gishu County, Kenya (Field data 2017)





Solar drying of wheat (too much rain during harvest) within Eldoret Town in Kenya, 2019



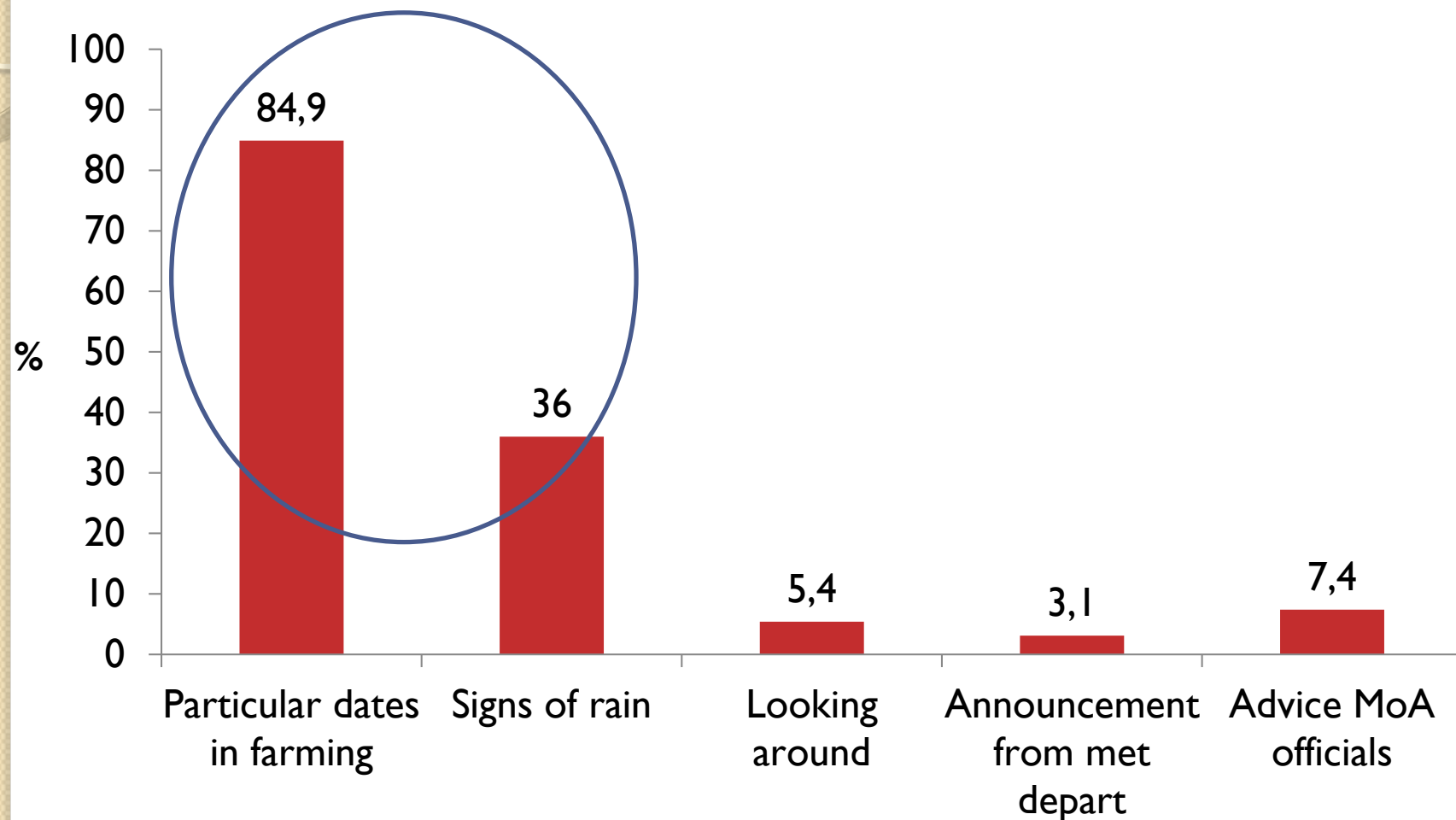
# DATA AND INFORMATION ACCESS IN SDG 2 AND 13 MITIGATION

- Open data and information has been in use over a number of centuries in agricultural systems - ---
- **Mesopotamians** wrote information on cuneiform and farmers in the 1700's observing patterns in the weather to predict when the best time to plant is ---
- Information recorded for use --- *availability of info was assured....*

# DATA AND INFORMATION ACCESS IN SDG 2 AND 13 MITIGATION






- The challenges of *climate variability* requires availability of *information* on *climate* and *weather* that will reflect *onset & cessation dates of seasonal rains* and *advisories* to help farmers in their farming decisions & avoid losses (Hansen, 2014).
- Adaptation strategies require quality *climatic and agronomic data and Information* on a spatial scale and time series known for it to be meaningful for agricultural planning (World Bank, 2010).

# Vulnerability---Information supporting farmers farm level decision– UG, 2013



# Farmers Calendar



DEC	JAN & FEB	MAR	APR	JUN	SEPT	OCT	NOV
<b>Know your crop and soil. Maize and wheat farm prepared</b>	<b>Prepare land and get inputs - fertilizer purchase etc</b>	<b>Planting both Maize and Wheat, weeding, spraying, and top dressing.</b>			<b>Harvesting, drying, marketing of crop and storage. Post-harvest handling</b>		
<b>Know your past climate</b> 	<b>Get Seasonal Forecast</b>  <b>Measure rain</b>	<b>Get forecast updates</b>  <b>Measure rain</b>		<b>Get Seasonal Forecast</b>  <b>Measure rain</b>	<b>Get forecast updates</b>  <b>Measure rain</b>		

# TYPE OF INFORMATION PRODUCT/ SERVICES TO MITIGATE SDG 2 AND 13

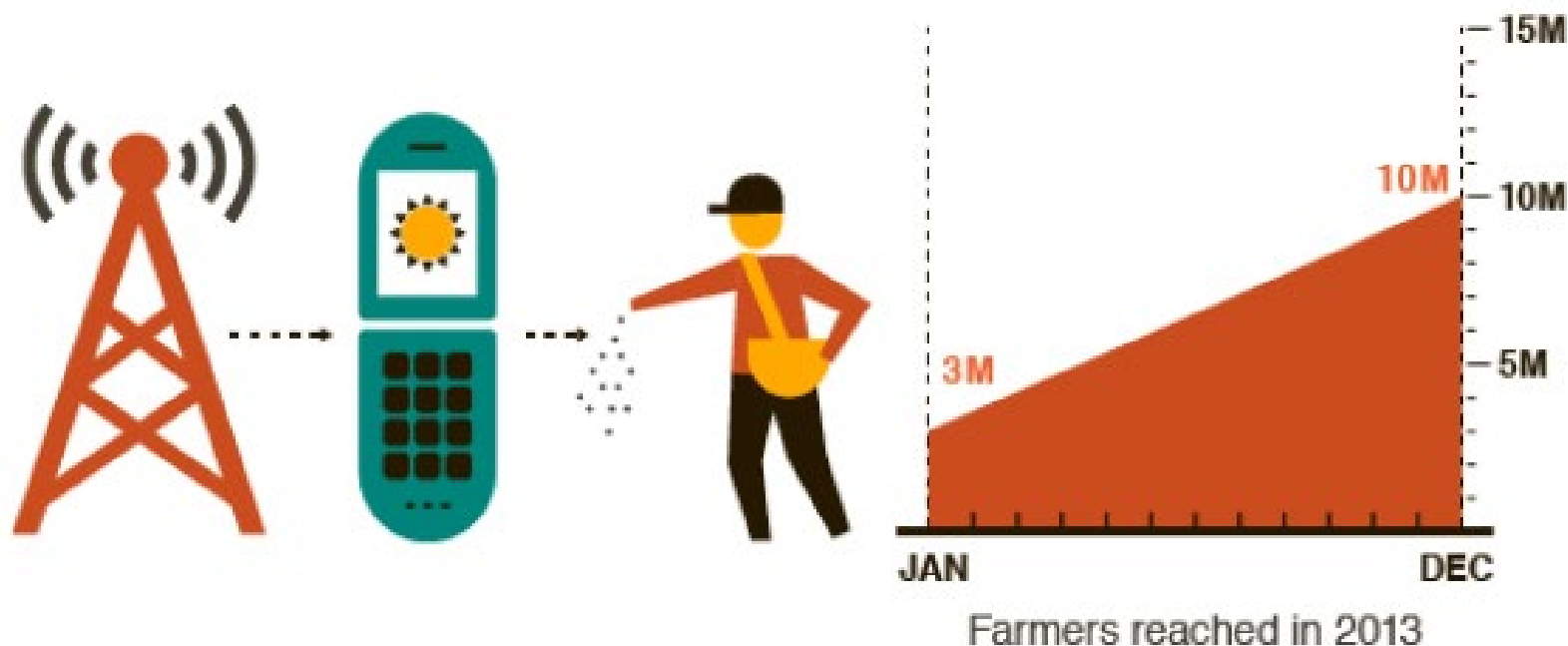
- **Assessments:** Monitoring for sector analysis and impact studies.
- **Analogues:** Historical analyses of archived data for comparative studies (similar years on record).
- **Forecasts:** Early-alert of impending episodic events affecting agriculture, such as flooding, drought, severe storms, heat wave, freeze etc.
- **Outlooks:** Guidance for long-term scenario analyses, including impact of climate extremes, variability and change.

# Type of information product/ services to mitigate SDG 2 and 13

- **Advisories** on farm management: -- Rainfall onset & cessation dates, planting/harvesting dates , weeds and disease spraying, irrigation scheduling...
- **Decision-Making Process:** Right information to the right user at the right time in the right format for informed decision making!....  
(Downscaled and tailored info)
- **10-day summaries** of crop and weather advisories, Plant density and soil moisture...

# EXAMPLES: WEATHER-BASED AGRICULTURAL ADVICE BOOSTING AGRICULTURAL PRODUCTION IN INDIA

In India, the Integrated Agrometeorological Advisory Services delivers crucial weather info to farmers to help them adapt. It aims to exceed its target of **10 MILLION FARMERS** in 2014.



Source: Aggarwal, 2013

## Big Facts

[ccaafs.cgiar.org/bigfacts](http://ccaafs.cgiar.org/bigfacts)



RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security





# EVIDENCE OF SUCCESS FOR SERVICES (BIG FACTS)

## SERVICES

Seasonal rainfall forecasts are helping farmers in Senegal make decisions in a changing climate.



**2 MILLION** farmers in Senegal receive 10 day forecasts

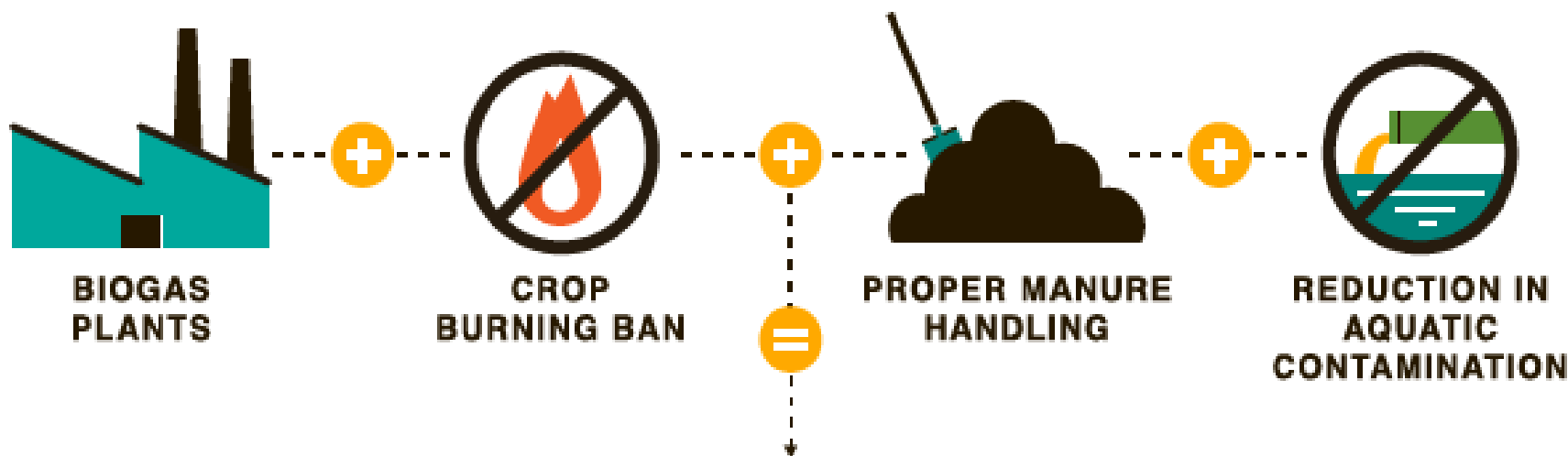


2.5 million farmers in India receive 5-day forecasts and advice, having **A 10 BILLION USD IMPACT.**



# REDUCING GREENHOUSE GAS EMISSIONS FROM AGRICULTURE IN DENMARK, (BIG FACTS, 2018)

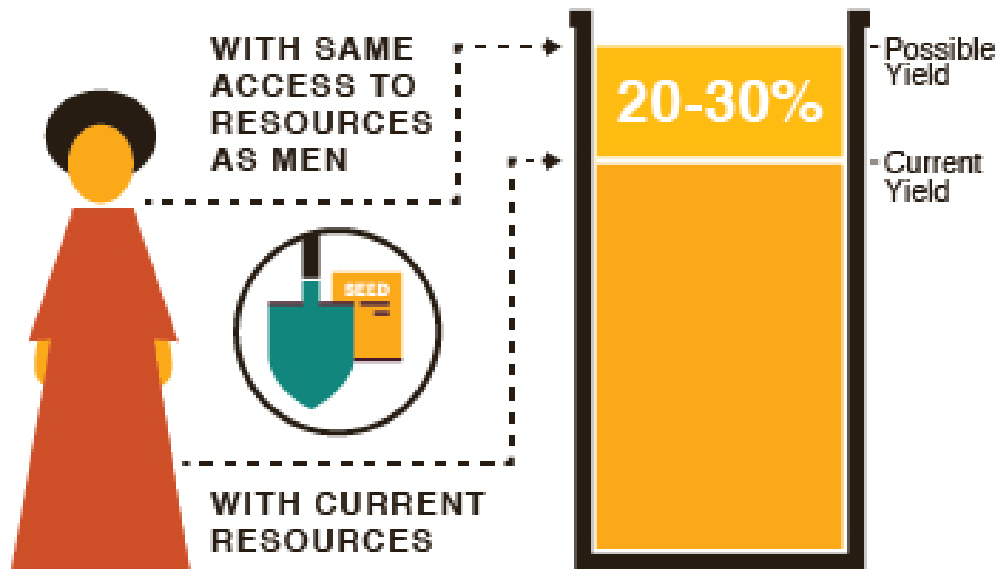
Denmark slashed agricultural emissions 28% by tackling multiple sources.



**28% REDUCTION IN GHGs**  
AND SUSTAINED GROWTH FROM 1990–2010

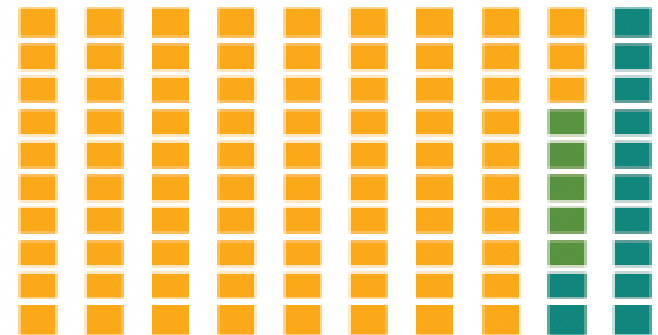
# GENDER DYNAMICS (FAO, 2011; IFAD, GENDER IN AFRICA SOURCEBOOK)

If women had access to resources, on-farm yields could **INCREASE BY 20-30%**.



This extra output could reduce the number of hungry people in the world by

**12-17%**



# SUMMARY - TYPE OF INFORMATION PRODUCT/ SERVICES CONT...

## Improving Agricultural Observatory: World Bank Supported



### Global Field-level Insight

- Location-specific information to drive decisions
- Detailed agriculture-specific weather forecast
- Global footprint means coverage in rural areas



### Increase Smallholder Farmer Yield

- Access to the most current agriculture data
- Growth stage monitoring predicts farmer input timing
- Climate-smart growing recommendations

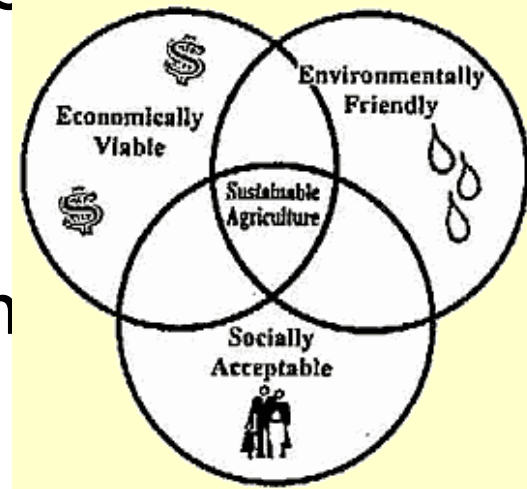


### Localized Agronomic Tips & Info

- Send the right tips to the right farmers at the right time
- Pest & disease forecast alerts help farmers prepare
- Crop suitability assessment enables credit risk scoring

# INFORMATION ACCESS - SUSTAINABLE & CLIMATE SMART AGRICULTURE

- *Sustainable Agriculture (SA)* refers to the ability of a farm to produce food indefinitely, without causing irreversible damage to ecosystem health.
- *Climate-Smart Agriculture (CSA)* ) is an integrated approach to managing landscapes—cropland, livestock, forests and fisheries--that address the interlinked challenges of food security and climate change.





CSA consists of three main pillars anchored on access to information:-

- *Sustainably increasing agricultural productivity* and incomes especially rural people dependent on agriculture for livelihoods
- *Adapting and building resilience to climate change....* Reduce vulnerability to drought, pests, disease and other shocks + improve capacity to adapt.
- *Reducing and/or removing carbon emissions*

# Examples

- *China since 2014* - improved soil conditions, and boosted production of rice by 12% and maize by 9% & More than 29,000 farmers reported higher incomes + increased climate resilience
- *Senegal, the West Africa Agricultural Productivity Program (WAAPP)* has developed seven new high-yielding, early-maturing, drought resistant varieties of sorghum and millet in 2012.
- The varieties are being widely diffused to farmers and show positive yield results

# AGRICULTURAL INNOVATIONS...

## EXAMPLES

- Perennials have the capacity to retain more nutrients and sequester more carbon than annuals (New Agriculturalist)
- Reintroducing orphan crops into agriculture: *Diversifies diets, increases nutrition, increases crop biodiversity*. Examples: Sorghum, Sweet potato, Cowpea, Cassava etc.
- *Payment for Environmental Services (PES)*. Pay farmers for ecosystem services including carbon sequestration, watershed services, biodiversity conservation (FAO PES)

# RECOMMENDATIONS

- Building *high-level policy and public and private institutional support* for Open Access to data and information.
- Achieve a sustainable, optimized production level through the use of *weather & agronomic data* while maintaining environmental integrity and minimizing the degradation of soil, nutrient and water resource bases & ecosystem.
- Consumption adjustment & waste reduction




# RECOMMENDATIONS

- Farmers to make effective decisions with more precision operations through the *accessibility of open data and information*.
- Governments to guarantee that *climate information available at national or regional levels* is distributed to those groups in civil society which support or represent vulnerable groups.
- Access to *information on new technologies* (e.g. methane inhibitors)
- Access to *information on incentives for carbon reductions* (carbon credits)

## RECOMMENDATIONS

- Agro-meteorological services to target the use of mobile phones to disseminate their *products and services— info access*.
- Incorporating farmers perspectives through fusing on *traditional knowledge systems and scientific information* for synergy forecasting. (scenario building) + CSA and SA
- Climate modelers need to better understand end-user needs regarding required variables, data format, temporal frequency, spatial scale, length of data period and all important parameters for information to have impact.

- 
- Researchers to focus more on research that is geared towards *solving local community problems* if we have to attain targets in SDG 2 and 13
  - Community diagnosis for home grown solutions if research has to have any impact or sense amongst our local communities and the nation... hence impact on SDGs and Vision 2030.

# ASANTE SANA

# THANK YOU

**13** CLIMATE  
ACTION



**2** ZERO  
HUNGER

